Appendix B:

Stream Habitat Assessment Methods
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STREAM SEGMENTS
Reach breaks are determined by changes in gradient, channel confinement, and riparian landuse. If available use the TFW or SSHIAP segment boundaries. These breaks can be determined using GIS technology and confirmed in the field. Gradient categories are: <1%, 1-2%, 2-4%, 4-8%, and greater than 8-20% grade. Reach lengths should be 20 bankfull widths minimum length and 1200M maximum. Start and ends of reaches should be geo-referenced using GPS.

PREINVENTORY PREPARATION:
Determine length of the sample reach by calculating 25% of the survey reach length. At least twenty-five percent of a stream segment should be surveyed to adequately represent segment conditions (May 1996). The starting point of a survey reach must be chosen randomly.

FIELD METHODS
Habitat Inventory
Two persons, one with measurement and the other with note-taking tasks, conduct the surveys. Surveys will be conducted in an upstream direction during low flow conditions. The start and end of the survey reach will be marked with survey tape, so the GPS technician can identify and record the starting and ending locations. At the start of the survey hip chain string will be tied to known reference points; as the surveyors proceed upstream the locations and lengths of instream habitat units will be recorded. Habitat units will be identified as pools, riffles or other (see definitions below). Categories are kept simple to avoid compounding error due to observer differences. The lengths and widths of all habitat units will be recorded to the nearest 10 cm (4 inches). In pool habitats, maximum depth, and pool tail-crest depths will be recorded, as well as 4 thalweg depths. Pool Quality Index (PQI) (attached) will be determined for each pool using a rating system adopted from Platts et al. (1983). Pools receive a higher rating if they are deep, large in relation to the size of the channel and have additional features that provide cover for fish such as woody debris. Available discharge data will be noted on each survey day.
Habitat units are defined as:

Pool: Habitat units where scouring water has carved out a non-uniform depression in the channel bed or has been dammed. Slow water, with a width at least 1/2 of the wetted channel width and 20 cm minimum residual pool depth (Max. depth–pool tail-out depth). Surveyor should note if the pool is a dam pool instead of a scour pool. Backwater and side-channel pools should be included in the survey.

Riffle: Swiftly flowing, turbulent water with hydraulic jumps (white-water); some partially exposed substrate; substrate cobble and/or boulder dominated.

Other: Includes non-turbulent fast water habitat types such as **Glides**: wide, uniform channel volume, no thalweg, low to moderate water velocity, little surface agitation. Can appear pool like, but there is no significant scour depressions. Substrate is dominated by small materials. **Runs:** deep and fast with defined thalweg and little surface agitation. There may be flow obstructions in the form of boulders. Typical substrate is gravel, small cobble, cobble, small boulder, and boulders (definitions from Overton et al. 1997).

Large Woody Debris (LWD)

All pieces within the bankfull width and spanning the channel will be counted. Pieces with rootwads and/ or in debris jams will also be identified. LWD are defined as logs at least 2 meters (6 feet) long and at least 15 cm in diameter. The length and diameter of each qualifying piece of LWD will be measured and recorded in the habitat unit it occupies. The number of LWD pieces in a debris jam will be determined to the best of the surveyors ability and the volume of the DJ (including the small pieces) will be estimated from 3 dimensions: L x W x D.

REACH CHARACTERIZATION

Bankfull width and depth will be measured approximately every 25 m at riffles where the channel is relatively straight. At least 5 measurements will be taken per sample reach.
Locations of fences and other property boundary markers were identified by hip chain and noted on data sheets. Riparian vegetation type changes will be noted on the data sheets. Categories will be:

- Forested (> 20ft. in height), coniferous, mixed, or deciduous;
- Shrubs and/or vines (e.g. blackberries);
- Tall herbaceous (e.g. unmowed field, reed canary grass, etc.);
- Short herbaceous (e.g., mowed grass, pasture, etc.);
- Impervious (e.g. buildings, roads, asphalt, etc.);
- Residential landscaped (mowed lawn with ornamental shrubs/trees).

Presence and abundance (dominant or present) of invasive plant species are also noted (reed canary grass, blackberry, climbing nightshade, Japanese knotweed, etc. Use 4 letter abbreviations noted on the definition page.

BANK CONDITION

Bank stability will be determined at every riffle on each bank using the method described by Booth (1994). Categories are:

- **Stable**: vegetated or low bars to level of low flow, or stabilizing features (rootwads, vegetation, etc.)
- **Unstable**: imminent signs of erosion, or less than 50% vegetative cover.
- **Armored**: artificial bank protection of any kind (rip rap, wire mesh, etc.)

Stable banks show no signs of the following: Breakdown (clumps of bank are broken away and banks are exposed; slumping (banks have slipped down); tension cracking or fracture; vertical and eroding (the bank is mostly uncovered; i.e., less than 50% covered by perennial vegetation, roots, rocks of cobble size or larger and the bank angle is steeper than 80^{o}). (From Overton 1997).

SIDE CHANNELS, TRIBUTARIES, PIPES AND WETLANDS

- Location and size of pipes, and inflow or uptake will be noted. Tributaries and other side channels entering the stream will be mapped, and length and width of side channels will be measured.
- Locations of on-channel and nearby wetlands will also be noted and size will be estimated.
- Estimate numbers of fish, life-history stage (juvenile, adult), and species (if possible), and note in comments.
- Location of road and driveway crossings will be noted (these data should not be extrapolated beyond the survey reach).

REACH DESCRIPTION AND OTHER FEATURES

Other channel features such as fences crossing the stream, possible barriers to fish passage, culverts, areas of erosion or large sediment deposition, dominant substrate size, hillside seeps or springs, undercut banks,

overhanging vegetation, etc. were noted. For each survey reach, the surveyor will write a brief narrative (about three to four sentences, longer if necessary) describing the quality of habitat, species and life history stages observed, and relative abundance of fish and wildlife, and any obvious problems or concerns such as point of discharge or withdrawal, and opportunity and/or need for protection or a restoration project.

PHOTOGRAPHS

Photographs depicting the general nature of each characterized reach will be taken as the surveyors proceed upstream. Film rolls will be numbered and roll numbers, exposure numbers, and a description of the photograph will be noted on in the comments section of the field data sheets for later cross-reference. A single roll (KC 12 exp. Roll) will be used for each survey reach.

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Pool Quality Index (PQI) for Puget Sound Lowland Streams (1st to 3rd Order)
(Modified from Platts et al., 1983)

Step	Description	PQI Score
1A	Maximum pool depth is >/ = to 1.0 m	**5**
1B	Maximum pool depth is < than 1.0 m…go to step 2	
2A	Pool wetted width spans most (>= 75%) of average wetted width…to step 3	
2B	Pool wetted width spans less than 75% of average wetted width…to step 5	
3A	Maximum pool depth < 0.5 m…to step 6	
3B	Maximum pool depth > 0.5 m…to step 4	
4A	Pool cover is abundant/ excellent	**4**
4B	Pool cover is fair to good	**3**
4C	Pool cover is poor	**2**
5A	Maximum pool depth is > 0.5 m, with good to excellent cover	**4**
5B	Maximum pool depth is > 0.5 m, with fair to poor cover	**3**
5C	Maximum pool depth is < 0.5 m, with good to excellent cover	**2**
5D	Maximum pool depth is < 0.5 m, with fair to poor cover	**1**
6A	Pool cover is excellent/abundant	**3**
6B	Pool cover is good to fair	**2**
6C	Pool cover is poor	**1**

Note: over conditions include LWD, over-hanging vegetation, undercut streambanks, and water surface agitation.

Stream Habitat Survey Data Sheet **King County DNRP, WLR Division**

Stream_____Segment_____Date_____
Start Location_____End Location_____Page_____of____
Start time_____End time_____
Write summary segment notes on reverse side of datasheet.
Water Temp_____F C Air Temp_____ Weather_____
Crew_____

Dist (m)	Habitat Unit		Pools								Wood		
	Type	Width	Type	Mean depths (4 #s)				Max Depth	Tail Depth	PQI	Type (L/RW/ DJ)	Diam	Length

Stream_____Segment_____Date_____

Measurements taken every 25 meters in straight riffles. Page_____ of _____

Dist. (m)	Bankfull		Riparian Veg.		Bank Stability: **S/U/A**		Invasives	Comments: Tribs., Fish use (#'s, Y/N), dominant and sub-dominant substrate, pipes, etc. with meter distances
	Width	Depth	RB	LB	RB	LB		

Dis	**Exp.**	**Description of photo**

Stream Habitat Survey Instructions — King County DNR, Water and Land Resources Division

General Instructions: First page is for recording habitat units and biological observations (habitat unit identification). Second page is for measurements taken at riffles every 25 meters. When finished with the sample reach, write a description of the habitat that may not be included in the data sheet—include a general substrate description.

Habitat Type:
P - Slow water, scour depression in channel bed, length and width at least 1/2 the bankfull channel width.
R - Swiftly flowing, turbulent water; some partially exposed substrate; substrate cobble and/or boulder dominated;
O –Glide: Wide, uniform channel volume, low to moderate water velocity, little surface agitation. Run: deep and fast with defined thalweg and little surface agitation. Enter OR, OG
W - Riparian Wetland

LWD:
Measure all, minimum 2 m (6 ft) length & 15 cm (6 in) diam, no min for stumps.
Qty/#: If DJ, enumerate as 1, measure 3 dimensions: L x W x H.
Type: L=Log, RW = Root-wad, DJ=Debris jam
Form Pool? Has the log caused a pool to form? (yes or no)

Pools:
Type: D: dam pool, S: scour pool.
Tail Depth: Water depth @ hydraulic control at d/s end of pool

FW Mussels: Freshwater mussels - are they present? Indicate relative abundance.
Fish?: Note whether salmonids (any age class) are seen in habitat unit. Estimate abundance.

Substrate (sizes refer to intermediate diameter):
F - Fines <6 mm
G - Gravel 7- 64 mm
C - Cobble 64-256 mm
B - Boulder >256 mm

Bank Condition:
S - Stable – vegetated or low bars to level of low flow
U - Unstable – steep, raw banks only below or above bankfull level
A - Armored – artificial bank protection of any kind

Riparian Type:

FD, FC, FM = Forested deciduous, coniferous or mixed
SH = Shrubs or vines
HT = Herbaceous tall (unmowed/ungrazed)
HS = Herbaceous short (mowed/grazed)
IMP = impervious (roads, pavement, buildings)
LAND = Landscaped (mowed lawn, ornamental shrubs/trees)

Invasives: Dominant (D) = >20% cover on bank over reach. Species: (first two letters of genus & species):
RUDI / RULA Himalayan blackberry (*Rubus discolor*) or Evergreen blackberry (*Rubus laciniatus*)
SODA climbing nightshade (*Solanum dulcamara*)
ILHE English ivy (*Ilex hedera*)
PHAR reed canary grass (*Phalaris arundinacea*)
SPDO spirea/hardhack (*Spirea douglasii*)
POCU Japanese knotweed (*Polygonum cuspidatum*)
IRPS yellow flag iris (*Iris pseudacorus*)
COAR bindweed (morning glory) (*Convolvulus arvensis*)
LYSA - purple loosestrife (*Lythrum salicaria*)

Notes: Describe quality of habitat, species, life history stages, relative abundance of fish and wildlife, and any obvious problems or concerns such as point of discharge or withdrawal, potential fish passage barrier, and opportunity and/or need for protection or a restoration project.